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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/769,490	01/26/2001	Kenji Itoga	49657-961	5521

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EXAMINER

KAO, CHIH CHENG G

ART UNIT

PAPER NUMBER

2882

DATE MAILED: 09/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/769,490

Applicant(s)

ITOGA ET AL.

Examiner

Chih-Cheng Glen Kao

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– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 July 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15, 24-43 and 46-49 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15, 24-43 and 46-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 January 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 19.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1, 2, 4, 14, 15, 24, 25, 27, and 37-39 are rejected under 35 U.S.C. 103(a) as obvious over Itabashi (JP 11-014800) in view of Bearden et al. (Reviews of Modern Physics).
2. With regards to claims 1 and 24, Itabashi discloses an x-ray exposure apparatus and method (Paragraph [0001]) comprising: an incidence step to an x-ray mirror and providing light having a component and peak in wavelength ranging from 0.45 nm through 0.7 nm (Paragraph [0012]), wherein a material of high reflectance is disposed at an outer most surface of the x-ray mirror (Abstract), and an oblique angle of the x-ray with respect to the x-ray mirror is in the range of 1.5° thereby providing the light at least having a component in weavelength ranging from 0.45 nm through 0.7 nm (Fig. 2a).

However, Itabashi does not specifically disclose the material having an absorption edge only in a wavelength region other than 0.45 nm through 0.7 nm, nor the oblique angle not more than 1.5° .

Itabashi further teaches a material such as ruthenium (Paragraph [0011]). Bearden et al. teaches ruthenium with an absorption edge only in a wavelength region other than 0.45 nm

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through 0.7 nm (Row in table containing element Ru). Note that when converting each of the edges from energy to wavelength using the equation for energy of photons ($E = hc/\lambda$), wavelengths occur in a region other than 0.45 nm through 0.7 nm.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have ruthenium with the device and method of Itabashi, since it would be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. One would be motivated to use this metal for the high reflection factor compared to light matter (Paragraph [0011]) as implied by Itabashi.

It would have also been obvious, to one having ordinary skill in the art at the time the invention was made, to have an oblique angle not more than 1.5° with the device and method of Itabashi, since where the general conditions of a claim are disclosed in the prior art, discovering the workable ranges involves only routine skill in the art. One would be motivated to use an oblique angle less than 1.5° with a wavelength of 0.6nm to have the x-ray reflect off the top of the mirror as shown by Itabashi (Fig. 2a).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the absorption edges of Bearden et al. with the device and method of Itabashi, since these properties were well known in the art at the time the invention was made as shown by Bearden et al. One would be motivated to have these properties so there is less loss of a signal at a particular wavelength.

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3. With regards to claims 2 and 25, Itabashi further discloses an x-ray incidence step using a synchrotron radiation source (Paragraph [0016]).

4. With regards to claim 4 and 27, Itabashi further discloses the mirror with ruthenium (Paragraph [0011]).

5. With regards to claims 14, 15, and 37, and 38, Itabashi further discloses the outgoing and incidence directions and optical axes of x-rays being substantially identical (Fig. 1).

6. With regards to claim 39, Itabashi further discloses an exposure step to manufacture a semiconductor device (Paragraph [0001]).

7. Claims 3 and 26 are rejected under 35 U.S.C. 103(a) as obvious over Itabashi in view of Bearden et al. as respectively applied to claims 1 and 24 above, and further in view of Uzawa et al. (US Patent 5524131).

Itabashi in view of Bearden et al. suggest a device and method as recited above.

However, Itabashi does not specifically disclose absorbing at least 90% of x-rays of a wavelength region of less than 0.3 nm.

Uzawa et al. teaches absorbing at least 90% of x-rays of a wavelength region of less than 0.3 nm (Fig. 6B).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the absorption of at least 90% of x-rays with wavelengths less than

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0.3 nm of Uzawa et al. with the suggested device and method of Itabashi in view of Bearden et al., since one would be motivated to differ the absorption factor to raise exposure luminous efficiency as shown by Itabashi (Paragraphs [0005] and [0006]) and since these properties are intrinsic to the mirror itself as implied from Uzawa et al. (col. 16, lines 60-65).

8. Claims 5, 7, 28, and 30 are rejected under 35 U.S.C. 103(a) as obvious over Itabashi in view of Bearden et al. as respectively applied to claims 1 and 24 above, and further in view of Oshino (US Patent 5677939).

Itabashi in view of Bearden et al. suggests a device and method as recited above.

However, Itabashi does not specifically disclose a converging mirror for converging.

Oshino teaches a converging mirror for converging (Fig. 1, #3).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have a converging mirror of Oshino with the suggested device and method of Itabashi in view of Bearden et al., since one would be motivated to use it to illuminate a surface in an arcuate pattern with uniform intensity as implied from Oshino (Abstract).

9. Claims 6, 8, 29, and 31 are rejected under 35 U.S.C. 103(a) as obvious over Itabashi in view of Bearden et al., as respectively applied to claims 1 and 24 above, and further in view of Sumiya (JP 3-120714).

Itabashi in view of Bearden et al. suggests a device and method as recited above.

However, Itabashi does not specifically disclose a magnifying mirror for magnifying the area of a region being irradiated.

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Sumiya teaches a magnifying mirror for magnifying the area of a region being irradiated (Abstract, Constitution, last 5 lines).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have a magnifying mirror of Sumiya with the suggested device and method of Itabashi in view of Bearden et al., since one would be motivated to use it to enlarge a radiation area for more exposure as implied from Sumiya (Abstract, Purpose).

10. Claims 9, 10, 32, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itabashi in view of Bearden et al. as applied to claims 1 and 24 above and further in view of Haisma et al. (US Patent 5622525).

Itabashi in view of Bearden et al. suggests an apparatus and method as described above.

However, Hasegawa et al. does not seem to specifically disclose a mirror as mechanically or chemically polished.

Haisma et al. teaches a mirror as mechanically or chemically polished (col. 5, lines 1-5, and col. 5, lines 11-26).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the mirrors polished mechanically or chemically of Haisma et al. with the suggested device and method of Itabashi in view of Bearden et al., since one may be motivated to polish a mirror to prevent irregularities as shown by Itabashi (Paragraph [0003]) for more controlled exposure, or for strict requirements imposed on the condition of the surface as implied from Haisma et al. (col. 5, lines 10-26).

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11. Claims 13, 36, and 40-43 are rejected under 35 U.S.C. 103(a) as obvious over Itabashi in view of Bearden et al. as respectively applied to claims 1 and 24 above, and further in view of Watanabe (JP 10-083955).

12. With regards to claims 13 and 36, Itabashi in view of Bearden et al. suggests a device and method as recited above.

However, Itabashi does not specifically disclose a plurality of mirrors.

Watanabe teaches a plurality of mirrors (Abstract, Solution).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have a plurality of mirrors of Watanabe with the suggested device and method of Itabashi in view of Bearden et al., since one would be motivated to use it to enhance the throughput of the light for exposure as implied from Watanabe (Abstract, Problem to be Solved).

13. With regards to claims 40 and 42, for reasons of being concise, Itabashi in view of Bearden et al. suggests a device and method as recited above. Itabashi further discloses an x-ray incidence step using a synchrotron radiation source (Paragraph [0016]), along with outgoing radiation from the source and reflected light from the mirror are substantially identical (Fig. 1).

However, Itabashi does not specifically disclose a plurality of mirrors.

Watanabe teaches a plurality of mirrors (Abstract, Solution).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have a plurality of mirrors of Watanabe with the suggested device and

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method of Itabashi in view of Bearden et al., since one would be motivated to use it to enhance the throughput of the light for exposure as implied from Watanabe (Abstract, Problem to be Solved).

14. With regards to claims 41 and 43, Itabashi further discloses the outgoing optical axes of x-rays from the source and mirror being substantially identical (Fig. 1).

15. Claims 11, 12, 34, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itabashi in view of Bearden et al. as applied to claims 1 and 24 above, and further in view of Rostoker et al. (US Patent 5374974).

Itabashi in view of Bearden et al. suggests a device and method as recited above.

However, Itabashi et al. does not specifically disclose an x-ray mask comprising a membrane of beryllium having an absorption edge only in either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to x-rays, and an absorber having an absorption edge in a wavelength region of at least 0.6 nm and less than 0.85 nm.

Rostoker et al. teaches an x-ray mask comprising a membrane of beryllium (col. 4, lines 65-69), and an absorber with a material such as tungsten, (col. 5, lines 4-10). Bearden et al. further teaches beryllium with an absorption edge only in a wavelength region other than 0.45 nm through 0.7 nm (Row in table containing element Be) as well as tungsten with an absorption edge in a wavelength region of at least 0.6 nm and less than 0.85 nm. Note that when converting each of the edges from energy to wavelength using the equation for energy of photons ($E = hc/\lambda$), wavelengths occur in the above said regions.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the mask of Rostoker et al. with the absorption properties of Bearden et al., since these properties were well known in the art at the time the invention was made as shown by Bearden et al.

Secondly, it would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the mask of Rostoker et al. with the absorption properties of Bearden et al. and with the x-ray exposure apparatus and method of Itabashi in view of Bearden et al., since it would have only involved routine skill and routine experimentation to discover the optimum or workable ranges of a mask in combination with a mirror for an x-ray exposure apparatus. One would be motivated to combine the mask with the mirror because one would want to insure that the intended wavelengths, which are reflected from the mirror, pass through the mask to reach the sample, while unwanted wavelength regions are absorbed by the mask. One would be motivated to use the mask of Rostoker et al. for its good transparency and absorbance as implied from Rostoker et al. (col. 10, lines 12-69 to col. 11, lines 1-40).

16. Claims 46-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itabashi in view of Bearden et al. as applied to claims 1 and 24 above and further in view of Hasegawa (JP 11-084098).

Itabashi in view of Bearden et al. suggests an apparatus and method as described above. Itabashi further discloses means for altering a peak wavelength (Figures 2 and 3).

However, Hasegawa et al. does not seem to specifically disclose maintaining a direction or optical axis.

Hasegawa teaches maintaining a direction or optical axis (Abstract, Solution).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to maintain the optical axis or direction of Hasegawa with the suggested device and method of Itabashi in view of Bearden et al., since one may be motivated to use it for supplying x-rays with a uniform intensity distribution by a high intensity as implied from Hasegawa.

Response to Arguments

17. Applicant's arguments with respect to claims 1-15, 24-43, and 46-49 have been considered but are moot in view of the new ground(s) of rejection.

18. With regards to Itabashi, Itasbashi still discloses that ruthenium is a known material of high reflectance. It would be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. One would be motivated to use this metal for the high reflection factor compared to light matter (Paragraph [0011]) as implied by Itabashi.

With regards to "peaked wavelength", choosing a wavelength of 0.6nm for the x-ray inherently makes the peaked wavelength ranging from 0.45nm to 0.7nm.

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Conclusion


Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chih-Cheng Glen Kao whose telephone number is (703) 605-5298. The examiner can normally be reached on M - F (9 am to 5 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (703) 308-4858. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.


gk
EDWARD J. GLICK
SUPERVISORY PATENT EXAMINER